

# Petr Stepanov

Materials science. Data analysis. Desktop and web applications development. UI/UX design.

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## Summary of Qualifications

### Work Experience

#### Research Collaborator (On-Site)

[Thomas Jefferson National Laboratory \(JLab\)](https://www.jlab.org), Newport News, VA, USA.

Jul 2020 - Current

- Coded a Geant4-based simulation for studying the optimal light guide length (range 0-10 cm) for the [EM calorimeter](#) used in the Electron-Ion Collider (EIC) project. [Link to GitHub](#).
- Used Machine Learning (ML) techniques to perform binary classification of thousands of signals from a data acquisition (DAQ) setup. [Link to GitHub](#).
- Applied CERN ROOT framework (C++) to perform statistical analysis of a significant amount (over 100 GB) of the raw experimental data of the [Kaon LT](#) experiment at JLab. [Link to GitHub](#).
- Utilized SLURM supercomputer environment to run programs on the JLab supercomputer environment simultaneously. This reduced the wall time by more than 10 times.
- Proposed and implemented RAMDisk functionality on the development environment. This led to an over 50% increase in source code indexing time.
- Set up data acquisition system that performs triggered waveform acquisition involving 3 devices - Tektronix oscilloscope, Network Attached Storage, and RedHat computer (SAMBA, Python, National Instruments NI-VISA library).
- Contributed 100+ shifts at the Hall C in Thomas Jefferson Particle Accelerator facility for the [Pion LT project](#).

#### Postdoctoral Researcher (Remote)

[Catholic University of America \(CUA\)](https://www.cua.edu), Washington, DC, USA.

Jul 2020 - Current

- Programmed a Geant-4 computer simulation (C++, CMake, Eclipse IDE, gdb) to study performance of a novel scintillation material for EIC, Brookhaven National Lab. [Link to GitHub](#).
- Visualized energy deposition profiles and calculated energy resolutions for variety of detector assemblies.
- Teaching experience. Mentoring students within a 3-month Research Experiences for Undergraduates (REU) program at the Physics Department at CUA. Giving talks and presentations about [Linux Terminal](#), and [supercomputer environment](#).
- Enhanced debugging of the core library source code led to the publishing of more than [10 bug reports](#) on the ROOT (C++) forum.

#### Research Assistant

[Bowling Green State University \(BGSU\)](https://www.bgsu.edu), Bowling Green, OH, USA.

Aug 2014 - May 2020

- Assembled positron lifetime and Doppler spectrometers from ORTEC and Canberra (Mirion) fast electronic units. Utilized High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems for single-photon counting.
- Developed three open-source programs (C++, CERN ROOT) for a novel interpretation of the positron lifetime and Doppler experimental spectra.
- Derived and solved kinetic equations describing the formation and chemical reactions of e<sup>+</sup> and Ps atoms in solids, liquids, and nano-powders (Wolfram Mathematica).
- Incorporated physical parameters (grain size, defect concentrations, rate constants) into custom models (PDFs with convolution) for fitting of the experimental spectra (RooFit).
- Above research allowed for estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations) and characterization of the chemical decoration of defects.
- Wrote three desktop GUI programs for spectra fitting and interpretation (C++, CMake, ROOT, Qt, Java)
- GitHub repositories contain over 10k lines of code in total: [TLIST Processor](#), [SW Calculator](#), [RooPositron](#).
- Extended default ROOT GUI library (Qt-based) to support the MVP design pattern.
- Wrote a GUI application [LuminApp](#) (Java, Swing) to parse and merge time-stamped data from optical spectrometer and thermometer. This increased data processing time by two orders of magnitude.

- Developed static website (Hexo, Gulp, Bootstrap) and visual identity for the [SelimLab](#) research group. The website has a 99% Google performance rank and features 700 ms time to interactive metrics.
- Maintained local Apache HTTP server [physics.bgsu.edu](#) hosting over 10 websites at the BGSU.
- Created website for the [ICPA-18](#) international conference with registration (over 150 users) and payment system workflow (WordPress, PHP, Recurly.js), and [landing pages](#) for events.

#### Frontend Developer, UI/UX Designer • Freelance

Sep 2012 - May 2020

- Designed and built an online e-commerce store [Sticker Store LLC](#) with a static website generator (Figma, Hexo, Snipcart, Bootstrap, SASS, Express.js, EJS, Node.js).
- Improved the Google PageSpeed Insights metrics (CLS, LCP) up to 97%.
- Created a recursive script to export over 300 products from YAML file to Google Merchant.
- Optimized SEO. The project reached over 1400 organic monthly users.
- Made iOS application (Swift, UIKit, storyboards) for the [We.Team](#) messenger (more than 3k monthly downloads in AppStore). Participated in cloud-based messenger development with enhanced file sharing capabilities (HTML, React JS, SASS).
- Migrated the landing page for [Sweetbridge](#) company from WordPress to Jekyll static site generator (Ruby, CSS). This resulted in a 70% improvement in the page load time.
- Developed the front-end part (Angular.js, HTML, LESS) for [Lili Social](#) network.
- Assisted with iOS mobile application (Ionic).
- Enabled SEO crawling of over 1000 Angular.js pages with Google bot.
- Web design.
- Designed logos, UI/UX prototypes (Figma, Sketch, Illustrator) and branding identity for over [10 different companies](#).
- Converted numerous design assets and mockups into responsive HTML and CSS.
- Mocked up and integrated dozens of cross-browser responsive email templates.

#### Full Stack Web Developer, Web Designer

[Gridnine Systems](#), Moscow, Russia.

Apr 2011 - Aug 2014

- Prototyped and designed interactive mockups for [Otixo](#) cloud file integrator (Balsamiq, Adobe Creative Suite). Utilized Google Web Toolkit (GWT) Model-View-Presenter (MVP) framework to develop application frontend (JavaScript, responsive CSS).
- Responsible for the front-end development of the [ATH American Express](#) – the largest travel management company in Russia (JavaScript, Backbone.js, and RequireJS). Increased the front-end load time by over 30%.
- Implemented image processing servlets on the backend to generate banners for five different social networks (PHP, ImageMagic).
- Wireframed and sliced to web pages numerous UI/UX mockups for web applications (Balsamiq, Photoshop, HTML and CSS).

#### Computer Science Teacher

[Phys-Tech College at MIPT](#), Moscow, Russia.

Oct 2009 - May 2011

- Provided instructions and guidance to high school students on following computer courses: C/C++ programming, HTML, Adobe Photoshop and 3D Studio Max.

#### Research Scientist

[Institute for Theoretical and Experimental Physics \(ITEP\)](#), Moscow, Russia.

Sep 2008 - Apr 2011

- Application of positron lifetime spectroscopy for studying the radioactive-induced defects in steels. Monte-Carlo particle simulations with Fortran 95. Maintaining software for CAMECA tomographic atom probe (MSVC). Application of CERN ROOT libraries for fitting and analysis of experimental spectra.

## Computer Science Skills

- **Essentials.** Git, SVN, SSH, Linux, and Terminal usage. BASH scripting. IDEs: Eclipse, Xcode, Visual Studio Code (VS Code).
- **Project management.** JIRA, Trello, GitHub, GitLab.
- **Simulation and data analysis:** Geant4, CERN ROOT, MATLAB, Wolfram Mathematica, Maple.
- **Academic writing:** LaTeX, MS Office Suite, Zotero.

- **Data plotting:** Gnuplot, OriginLab, QtiPlot, SciDaVis, Grapher.
- **Desktop app development.** C/C++, GNU make, CMake. Frameworks: Qt, CERN ROOT, Geant4. Java and Swing. Python.
- **Frontend:** HTML, CSS (LESS and SASS), Bootstrap, responsive web design, JavaScript and jQuery, npm, gulp, AngularJS, React.js. Google Web Toolkit. PHP and WordPress themes development.
- **Backend.** Node.js, Express.JS (EJS), Java.
- **UI/UX design.** Figma, Sketch, InVision Studio, Adobe XD, Adobe Photoshop, Adobe Illustrator, Inkscape, Balsamiq, Blender.
- **Apple iOS.** Fundamental Swift skills. User interface development with UIKit and storyboards.

## Material Research Skills

- **Characterization facilities.** Positron Lifetime and Doppler Broadening Annihilation Spectroscopy (PALS, DBAR). Atom Probe Tomography (ATP). Scanning Electron Microscopy (SEM). Transmission electron microscopy (TEM). Atomic Force Microscopy (AFM). UV-VIS Spectroscopy. Fourier Transform Infrared Spectroscopy (FTIR).
- **Material processing.** High-temperature annealing. Wet chemical etching. Electrical Contact Fabrication. Sample polishing.

## Education

### Bowling Green State University (BGSU) • Ohio, USA

Aug 2014 - May 2020

Ph.D. in Photochemical Sciences • GPA 3.423. Novel developments in positron annihilation spectroscopy techniques—from experimental setups to advanced processing software. [View manuscript](#).

- Assembled and utilized two spectrometers: positron lifetime and Doppler. Spectrometers are built from ORTEC and Canberra (Mirion) fast electronic units and utilize High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems.
- Developed open-source software (C++, CERN ROOT) for a novel interpretation of the experimental spectra.
- Defined and resolved kinetic equations of reactions of positron and positronium atoms (Ps) in solids and liquids and nano-powders (Wolfram Mathematica). Equation parameters are implemented in the fitting model of experimental spectra (RooFit).
- Above research allowed for the estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations), and more...

### Ohio Supercomputer Workshop • Ohio, USA

Jan 2017 - Feb 2017

Hands-on sessions in Supercomputer Essentials. Introduction to the key developments in the supercomputer field.

- RedHat and CentOS operating systems: environment, networking, and SSH.
- Supercomputer job control with BASH and SLURM scripts.
- CMake compiling platform, use of parallel nodes, A.I. fundamentals and more..."

### British Higher School of Art and Design (BHSAD) • Moscow, Russia

Dec 2011 - Feb 2012

Three-month intensive in Graphical Design and Visual Communications. Lectures and hands-on experience in graphic design and user interfaces.

- Intensive covered following subjects: brand identity, illustration principles, typography and lettering, effective advertising campaigns.

### National Research Nuclear University (MEPhI) • Moscow, Russia

Sept 2004 - Feb 2011

B.S. and M.S. in Solid State Physics. Defect studies of neutron-irradiated nuclear power plant vessel steels by means of positron annihilation spectroscopy.

## Featured Publications

- P. S. Stepanov, F. A. Selim et al. Interaction of positronium with dissolved oxygen in liquids. *Physical Chemistry Chemical Physics* **2020**, 22 (9), 5123-5131. [10.1039/c9cp06105c](https://doi.org/10.1039/c9cp06105c).
- P. S. Stepanov, F. A. Selim et al. A model for joint processing of LT and CDB spectra of dielectric nano-sized powders. *AIP Conference Proceedings* 2182 **2019**. [10.1063/1.5135836](https://doi.org/10.1063/1.5135836).
- P.S. Stepanov, S.V. Stepanov et al. Developing New Routine for Processing Two-Dimensional Coincidence Doppler Energy Spectra and Evaluation of Electron Subsystem Properties in Metals. *Acta Physica Polonica A* **2017**, 132 (5), 1628-1633. [10.12693/aphyspola.132.1628](https://doi.org/10.12693/aphyspola.132.1628).

## Conferences

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| <b>18th International Conference on Positron Annihilation (ICPA-18)</b><br>Orlando, FL, USA<br>Oral talk "Positions and Ps in Al <sub>2</sub> O <sub>3</sub> Nanopowders"  | <b>Aug 2018</b>  |
| <b>International Workshop on Physics with Positrons (JPos17)</b><br>JLab, Newport News, VA, USA<br>Poster "A routine of background subtraction from two-dimensional Doppler broadened spectra"   | <b>Sept 2017</b> |
| <b>12th International Workshop on Positron and Positronium Chemistry (PPC12)</b><br>Maria Curie-Sklodowska University, Lublin, Poland<br>Poster "Developing new routine for processing two-dimensional coincidence Doppler energy spectra"                 | <b>Sept 2017</b> |
| <b>Ohio Photochemical Society Meeting (Oops)</b><br>Maumee Bay Lodge & Conference Center, Maumee, OH, USA<br>Poster "Developing new routine for background subtraction in two-dimensional coincidence Doppler broadening spectroscopy"                     | <b>May 2017</b>  |
| <b>58th Electronic Materials Conference (EMC)</b><br>University of Delaware, Newark, DE, USA<br>Oral talk "High-Sensitivity Measurements of Defects in ZnO by Means of Digital Coincidence Doppler Broadening of Positron Annihilation Spectroscopy"       | <b>Jun 2016</b>  |
| <b>Annual Spring Meeting of the APS Ohio-Region</b><br>University of Dayton, Dayton, OH, USA<br>Oral talk "Identification of chemical environment of defects in ZnO by means of digital coincidence Doppler broadening of positron annihilation radiation" | <b>Apr 2016</b>  |
| <b>Ohio Inorganic Weekend</b><br>Bowling Green State University, OH, USA<br>Poster "Approaching Structural Defect Characterization and their Chemical Identification by Means of Coincidence Doppler Broadening of Annihilation Radiation"                 | <b>Nov 2015</b>  |
| <b>41st Polish Seminar on Positron Annihilation (PSPA-13)</b><br>Maria Curie-Sklodowska University, Lublin, Poland<br>Oral talk "Application of positron spectroscopy for detection of nanostructures in alcohol—aqueous mixtures"                         | <b>Sep 2013</b>  |

## Professional Networks

- Find examples of my code [on GitHub](#) (50+ repositories).
- Discover my professional contacts [on LinkedIn](#) (200+ connections).
- Skim through the list of my publications [on Google Scholar](#) (24 articles, 200+ citations).
- Check out my UI design portfolio [on Dribbble](#) (50+ shots).

## Interests

- Hosting an open-source project for keyboard remapping on Linux [300+ stars on GitHub](#).
- Contributing to the C++ open source framework ROOT. Created two shared libraries to facilitate data analysis. Links to GitHub: [CanvasHelper](#) and [RootUtils](#).